ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

DATE: **February 2000**

BUDGET ACTIVITY: **1 - Basic Research**

PE NUMBER AND TITLE: **0601101A In-House Laboratory Independent Research**

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	12139	14119	14459	14763	14997	15218	15437	Continuing	Continuing
A91A In-House Laboratory Independent Research - Army Material Command	8128	9761	10022	10261	10415	10560	10700	Continuing	Continuing
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	3352	3637	3703	3758	3831	3901	3978	Continuing	Continuing
A91D In-House Laboratory Independent Research - Corps of Engineers	659	721	734	744	751	757	759	Continuing	Continuing

A. Mission Description and Budget Item Justification: In-House Laboratory Independent Research (ILIR) provides a source of competitive funds to technical directors to stimulate high quality, innovative research with significant opportunity for payoff in Army warfighting capability. The ILIR program serves as a catalyst for major technology breakthroughs by giving laboratory directors flexibility in implementing novel research ideas and nurturing senior researchers as well as the most promising, developing scientists. The ILIR funding allocation is based on the quality of past performance. Each year, ILIR project reports are submitted from competing Army research organizations to the Office of the Assistant Secretary of Army (Research, Development, and Acquisition). These ILIR reports are subjected to a strenuous technical peer review by a review committee composed of leading scientists and engineers from the National Academy of Sciences, the Army Science Board, and Army Secretariat. ILIR funding allocation for the subsequent year is based on the score assessed by the ILIR review committee. Successful ILIR projects are typically transitioned to start-up projects under 6.1 or 6.2 mission funding within the organization. Since its establishment by DoD Directive number 3201.4, dated October 8, 1993, the Army's ILIR program has supported and will continue to promote the 1987 Defense Science Board Study on Technology Base Management's recommendation to attract and retain top flight science and engineering PhDs.

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B. Program Change Summary	FY 1999	FY 2000	FY 2001
Previous President's Budget (FY 2000 PB)	13574	14193	14499
Appropriated Value	13678		
Adjustments to Appropriated Value			
a. Congressional General Reductions	-104		
b. SBIR / STTR	-268		
c. Omnibus or Other Above Threshold Reductions		-40	
d. Below Threshold Reprogramming	-1167		
e. Rescissions		-34	
Adjustments to Budget Years Since FY 1999 PB			-40
Current Budget Submit (FY 2001PB)	12139	14119	14459

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BUDGET ACTIVITY **1 - Basic Research**	PE NUMBER AND TITLE **0601101A In-House Laboratory Independent Research** PROJECT **A91A**

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A91A In-House Laboratory Independent Research - Army Material Command	8128	9761	10022	10261	10415	10560	10700	Continuing	Continuing

Mission Description and Justification: This project provides funding for ILIR research, allocated among the seven Research, Development and Engineering Centers (RDECs) in the Army Materiel Command (AMC).

FY 1999 Accomplishments:

- 8128 - Missile RDEC – Conducted research on transparent metals and IR emissivity control for new and improved missile sensors, gel propellant for rocket/missile propulsion, chaos control techniques for guidance and control, and computational fluid dynamics for structural capabilities.
  - Armaments RDEC – Evaluated micro-electro mechanical systems (MEMS) technology for low-cost projectile guidance and control (G&C) and material characteristics and advanced energetic materials for improved propellants and explosives.
  - Tank-Automotive RDEC – Developed advanced propulsion simulation tools to upgrade ground vehicles quicker and cheaper; completed assessment of non-linear military vehicle dynamics to make next generation vehicles lighter and more mobile; developed advanced ground vehicle signature algorithms to significantly enhance vehicle survivability.
  - Natick RDEC – Validated models of materials/fabric/food; transferred results to the clothing program by providing scientific understanding of air-humidity interactions for improved clothing comfort and utility; transferred results to the rations program by providing tools for precise measurement of moisture distribution in rations to improve quality.
  - Edgewood RDEC – Initiated a project to examine the feasibility of developing sensors to detect viruses. Started development of new data reduction/analysis algorithms that would be required for satellite/high altitude chemical imaging sensors.
  - Aviation RDEC – Demonstrated the feasibility of an oscillatory-blowing concept to eliminate rotor airfoil stall in a 2-D model test; demonstrated the capability of Particle Image Velocimetry (PIV) to measure 2-D instantaneous velocity fields; developed mathematical model for the active-elevon concept and integrated it into a comprehensive rotorcraft analysis code; developed a more computationally efficient wake-tracing technique to capture rotor wake during blade/vortex interaction; developed family of slotted airfoils with 20% higher maximum lift/drag ratio.
  - Communications-Electronics RDEC – Investigated IR imaging technology in military medicine; reduced size of VHF and UHF microstrip antennas for conformal platform applications; developed and evaluated advanced electrolytes for lithium rechargeable batteries; modeled the electromagnetic propagation/interference of phased array antennas improves communications-on-the-move capabilities; established framework to transition research on mid-IR laser using difference frequency generation.

Total 8128

FY 2000 Planned Program:

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	PROJECT **A91A**

•	9596	- Missile RDEC – Conduct research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities; demonstrate and transition components and concepts. - Armaments RDEC – Conduct research on meta stable intermolecular composites (nanoparticle explosives), advanced low cost fuzing technology (MEMs, multi-function processing), advanced barrel coating modeling, and effects of high flame temperature and high pressure on current and Future Combat Systems. Evaluate smart materials for projectile in-flight course correction. - Tank-Automotive RDEC – Improve unique advanced propulsion technology, sophisticated multibody ground vehicle dynamic systems, and advanced signature management techniques to develop future vehicles that are lighter, more mobile, and highly survivable. - Natick RDEC – Validate mathematical models to gain insights into protective properties, strength of fabrics, and aerodynamics of parachutes. Perform nanotechnology research to create new high performance polymers for fabrics and protection applications. - Edgewood RDEC – Conduct research to prove concept for a specific virus detector. Begin construction of data reduction/analysis algorithms needed for the development of a satellite/high altitude chemical imaging sensor. - Aviation RDEC – Focus on optimization of blowing-slot location, frequency of oscillation and amplitude of blowing in the dynamic stall environment; construct full scale Particle Image Velocimeter; develop design approaches and concepts to integrate the actuation system with the blade structure to achieve a continuous elastic deformation of the airfoil contour near the trailing edge of the blade. - Communications-Electronics RDEC – Transition antenna technologies: improve power sources technology, advance sensor technology base.
•	165	- Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.
Total	9761	

FY 2001 Planned Program:

•	10022	- Missile RDEC – Conduct research on high quality projects leading to new and improved missile sensors, propulsion, guidance and control, and structural capabilities; demonstrate and transition components and concepts. - Armaments RDEC – Characterize meta stable intermolecular composites. Conduct research in the area of composite material in the areas of high pressure loading (i.e. gun components). Conduct research on smart material designed to provide in flight course corrections. - Tank-Automotive RDEC – Evaluate/validate the accuracy and sensitivity of warfighting requirements simulation models for advanced propulsion, non-linear multibody dynamics, signature management and nontraditional material stress analysis. - Natick RDEC – Transition results from biotechnology efforts to improved food safety and chemical protective fabrics. - Edgewood RDEC – Conduct research for a specific virus detector based on previously validated concepts. Continue construction of data reduction/analysis algorithms needed for the development of a satellite/high altitude chemical imaging sensor. - Aviation RDEC – Validate concepts for “smart materials” and/or micro-electro mechanical systems (MEMS) for alleviation of dynamic stall to improve rotor aerodynamics. - Communications-Electronics RDEC – Upgrade battlefield visualization tools; transition newly developed antenna technologies; improve power sources technology; advance sensor technology base.
Total	10022	

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BUDGET ACTIVITY: 1 - Basic Research

PE NUMBER AND TITLE: 0601101A In-House Laboratory Independent Research

PROJECT: A91C

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A91C In-House Laboratory Independent Research - Medical Research and Materiel Command	3352	3637	3703	3758	3831	3901	3978	Continuing	Continuing

Mission Description and Justification: Represents funds to conduct ILIR research allocated among the six laboratories of the Medical Research and Materiel Command, including the Aeromedical Research Laboratory, the Institute of Surgical Research, the Institute of Environmental Medicine, the Medical Institute of Chemical Defense, the Medical Institute of Infectious Diseases and Walter Reed Army Institute of Research.

FY 1999 Accomplishments:

- 2152 - Conducted research to examine transcutaneous immunization. Researchers discovered that application of cholera toxin to the skin resulted in immunization against the cholera toxin and other substances mixed with the toxin. Research in this area may eventually lead to use of a "band-aid" to administer vaccines.
  - Conducted research to explore the different types of brain cell death and mechanisms to stop secondary damage that frequently occurs after initial brain trauma. The development of neural brain cell therapy appears to be a promising avenue for restoring part of the brains injured tissue and functions.
  - Evaluated gene level expression of one species of malarial parasite derived from previous studies. Findings will facilitate development of drugs and vaccines that will interact with the gene products discovered through this process.
- 1200 - Examined feasibility of using genetically engineered plants to produce proteins associated with human diseases. The use of plants will provide a low cost source for effective multivalent vaccines against a variety of disease producing organisms. Preliminary results have demonstrated the feasibility of producing an important plague vaccine protein in plants.
  - Explored use of cDNA microarrays to measure thousands of gene responses to Filovirus infection of human cells in culture. Identified a pattern of gene expression related to immune system modulators that may help to develop therapeutic drugs against Filovirus infections.

Total 3352

FY 2000 Planned Program:

- 3541 - Solicit basic research proposals and make awards that focus on militarily relevant research to identify countermeasures against infectious diseases, defenses against environmental extremes and operational hazards to health, and mechanisms of combat trauma and innovative treatment and surgical procedures. Monitor progress of research and evaluate scientific results from final reports.
- 96 - Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.

Total 3637

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BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91C

FY 2001 Planned Program:

•	3703	- Solicit basic research proposals and make awards that focus on militarily relevant research to identify countermeasures against infectious diseases, defenses against environmental extremes and operational hazards to health, and mechanisms of combat trauma and innovative treatment and surgical procedures. Monitor progress of research and evaluate scientific results from final reports.
Total	3703	

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BUDGET ACTIVITY: **1 - Basic Research**

PE NUMBER AND TITLE: **0601101A In-House Laboratory Independent Research**

PROJECT: **A91D**

COST (*In Thousands*)	FY 1999 Actual	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	Cost to Complete	Total Cost
A91D In-House Laboratory Independent Research - Corps of Engineers	659	721	734	744	751	757	759	Continuing	Continuing

Mission Description and Justification: Represents funds to conduct ILIR research allocated among the four laboratories within the Army Corps of Engineers, including the Topographic Engineering Center, the Waterways Experimental Station, the Construction Engineering Research Laboratories and the Cold Regions Research and Engineering Laboratory.

FY 1999 Accomplishments:

- 659 - Integrated the convolution equation as part of an approach to reduce the effects of image data noise.
  - Began development of a response- and durability-based model for coal tar seal coats for asphalt pavements.
  - Developed a 2-D distributed watershed model incorporating radar precipitation data for stream flow forecasting.
  - Demonstrated feasibility of measuring snowpack water equivalence with Frequency Modulated Continuous Wave radar for flood prediction.
  - Investigated Microbiology influenced corrosion processes.

Total 659

FY 2000 Planned Program:

- 718 - Reduce image noise by developing a new adaptive interation technique.
  - Develop a response- and durability-based model for coal tar seal coats for asphalt pavements.
  - Begin development of a hydrologic model combining surface water with saturated and unsaturated groundwater.
  - Demonstrate ultra-broad-band radar techniques to reduce false alarm rates from surface variation to improve mine detection.
  - Begin exploration and optimization of transport characteristics of charged particles in soil for potential electrostatic absorption.
- 3 - Small Business Innovative Research / Small Business Technology Transfer (SBIR/STTR) Programs.

Total 721

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BUDGET ACTIVITY 1 - Basic Research	PE NUMBER AND TITLE 0601101A In-House Laboratory Independent Research PROJECT A91D

FY 2001 Planned Program:

•	734	- Transition techniques developed for image noise reduction. - Complete development of a response- and durability-based model for coal tar seal coats for asphalt pavements. - Develop a hydrologic model combining surface water with saturated and unsaturated groundwater. - Demonstrate the potential to detect/discriminate unexploded ordnance using trace chemical detection. - Develop techniques for directed sub-surface migration/concentration of contaminants through soils using electro-osmotic pulse technology.
Total	734	